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Weather influences on the high winter cereal yields of the 1981/82 season
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Agricultural Memorandum No. 963

Introduction

The 1982 cereals harvest was a bumper one in many parts of the country. This Memorandum derives from a discussion meeting on that 1982 cereal crop held in November 1982 by the North Bucks Soil Management Study Group.

Farmers in the Group operated three rotation types (I, II and III); their annual winter cereal yields under each type are tabulated below.

AVERAGE WINTER CEREAL YIELDS

A. WHEAT

Groups: I. Continuous cereals for over 10 years - no ploughing

II. Normal North Bucks arable rotation - wheat, barley and oilseed rape

III. Cereals with a grass break - 5-7 year leys

Year	Group yields (cwt/ac)				
	I	II			III
1976	41	40	-	-	-
1977	40	45	37	-	-
1978	52	40	39	-	-
1979	43	34	38	-	47
1980	43	47	44	48	48
1981	41	44	39	47	52
1982	55	52	45	54	68
1980-82 Av	46	48	43	50	56
1976-81 Av	43	42	39	-	49

B. BARLEY

Year	Group yields (cwt/ac)				
	I	II			III
1976	50	37	-	-	-
1977	62	35	36	-	-
1978	38	40	40	-	-
1979	36	34	39	-	40
1980	53	48	47	50	43
1981	38	-	40	38	50
1982	54	52	43	55	54
1980-82 Av	48	46	43	48	49
1976-81 Av	46	39	40	-	44

The 1982 yields are generally well above (by up to 14%) the 1976-81 averages and Hough (Private Communication) noted that this variation is very unlikely to be due to the direct effects of weather which is borne out when we later summarised the Pest and Disease incidence.

The 1982 weather (Gloster 1982) summarised in a form suitable for Study Group presentation on an OHP transparency follows below:

Cereals Weather 1981/82

Exceptional : December 1981 and June 1982.

Sept: High smds at beginning then WET and WINDY.

Oct : Changeable, WET (up to twice average)

Nov : half average rainfall in S.E.

Dec : coldest since 1890 in S.E. : Mean temps 5°C below average.

Flooding in thaw at end of month.

Jan : very cold mid-month. Frost damage to field crops not covered by snow.

Feb : mild, dry

March: sunny, wet

April: long dry spell (half av. rainfall)

May : dry, sunny, some large smd's.

June : very WET, lodging, disruption of haymaking.

July : first half unsettled, then dry.

August : unsettled, many rainy days but less than ½ average rainfall in rainy days but less than ½ average rainfall in S. Strong winds at end of month - grain loss.

Graphical presentation

Meteorological data for the N Bucks area 1977-82 are presented graphically as a departure from, or percentage of, average as appropriate (Figs 1 to 3). The 1982 weather derived from Weekly Notes information are presented in more detail in Fig 4.

By intercomparing the monthly averages for the years in which yields were 'above' or 'below' average when averaged over several rotation types and fields a qualitative picture was attempted of appropriate weather sequences leading to the observed yield rating. Thus in Fig 5 the 'poor' years for winter barley yields (1981, 79 and 78) show a consistent weather pattern of: cool, wet, dull springs with low June sunshine while good years had a far less identifiable pattern:

sunny and dry in late spring, wet June, dull in early summer.

Appropriate weather over the preceding autumn and winter was as follows:

Poor years : warm and dry in early winter, cold later.

good years : dry, sunny autumn, dry winter.

(These latter conditions perhaps reflect the ability to sow the winter cereals in good time under good seedbed conditions).

Soil Moisture Deficits

Fig. 6 illustrates that the 1982 summer smd under cereals never exceed 100 mm until late July, although a value of 50 mm was achieved by early May as in 1980.

In other years the value of 100 mm was exceeded as follows:

1981	about July 10	1978	June 30
1980	May 20	1977	June 30
1979	June 15		

The 1982 smd's thus suggest that the cereal crop was under moisture stress until a late stage.

It is noteworthy that one farmer recording exceptionally high yields had sown very early in 1981. Subsequently the high rainfall of late September and October delayed sowing further. In this (1982) autumn early sowing will again have paid dividends, due to subsequent very high rainfall and associated adverse soil conditions. See table below.

Rainfall: % of average for N Bucks

week ending:	1982	1981
Sept 4.	75	0
11	20	140
18	10	300
25	200	115
Oct 2	300	230
9	240	120
16	95	50
23	340	180

As stated earlier the high yield cannot be accounted for by direct weather effects and we must study the indirect influences of pests and diseases:

Cereal Aphids

There was a marked lack of cereal aphids due to a) the reduced population due to the severe winter, b) the over-wintering survivors failed to multiply significantly due to the dull, wet June.

Diseases

This was a low disease year for cereals probably due to the comparatively dry period to mid-June. Thus Septoria was low in barley while the wheat diseases Fusarium and Botrytis were at a similar low level.

Disease then was not a limiting factor to good yields due not only to weather but also to the fact that farmers sprayed excessively on the basis of 1981 having been a high disease year.

N Application

Seedbed N was applied 7 Oct 1981, autumn N on 26 Oct, February N on 17 February 1982. Growth Stage 30 N was applied on 24 March 1982 (ie the main dressing as the growth went from tillering to the reproductive phase.) (The split N dressing with 40 kg/ha at tillering and remainder at GS30 was better than a single treatment at GS30 for all N rates above 140 kg/ha. There is no indication of any yield advantages from autumn N).

The March application was during a dry spell following a very wet period in mid-month (to 20th). Rain fell again on 29th. Thus N application was at a time of moist soil conditions, followed by timely rain.

Summary

The direct and indirect effects of weather on cereal yields in 1981/82 have been discussed in a qualitative manner. It is interesting to compare the common factors of good and poor yield years with the list compiled by Hough (Ag Mems 892 etc) ie winter cereals yield better the longer the 'closed canopy' is available to intercept light. This is affected by:

a. cold May/April causes delay

b. ample N fertiliser in spring increases leaf production and effect promoted by moist soil.

c. cool June and July delay senescence.

d. sunny and bright in May/June; dull weather reduces yield.

e. Smds over 100 mm reduce yields, markedly so over 150 mm.

Weather conditions were unlikely to have been the direct reason for the good harvest, rather disease and pests were much less limiting than usual due to indirect weather effects.

Other factors such as timely sowing in a well prepared seed bed, the timely application of N to allow take up by soil without leaching and the weather conditions at harvest will be important.

Acknowledgements

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References

Gloster J (1982) — The weather in England and Wales: September 1981 to August 1982 To be published in Jour. Roy.Agric.Soc. Engl.

Hough M N — Ag Mems 892, 926

Please refer all comments and suggestions to the author.

Meteorological Office
MAFF Reading

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Fig 1

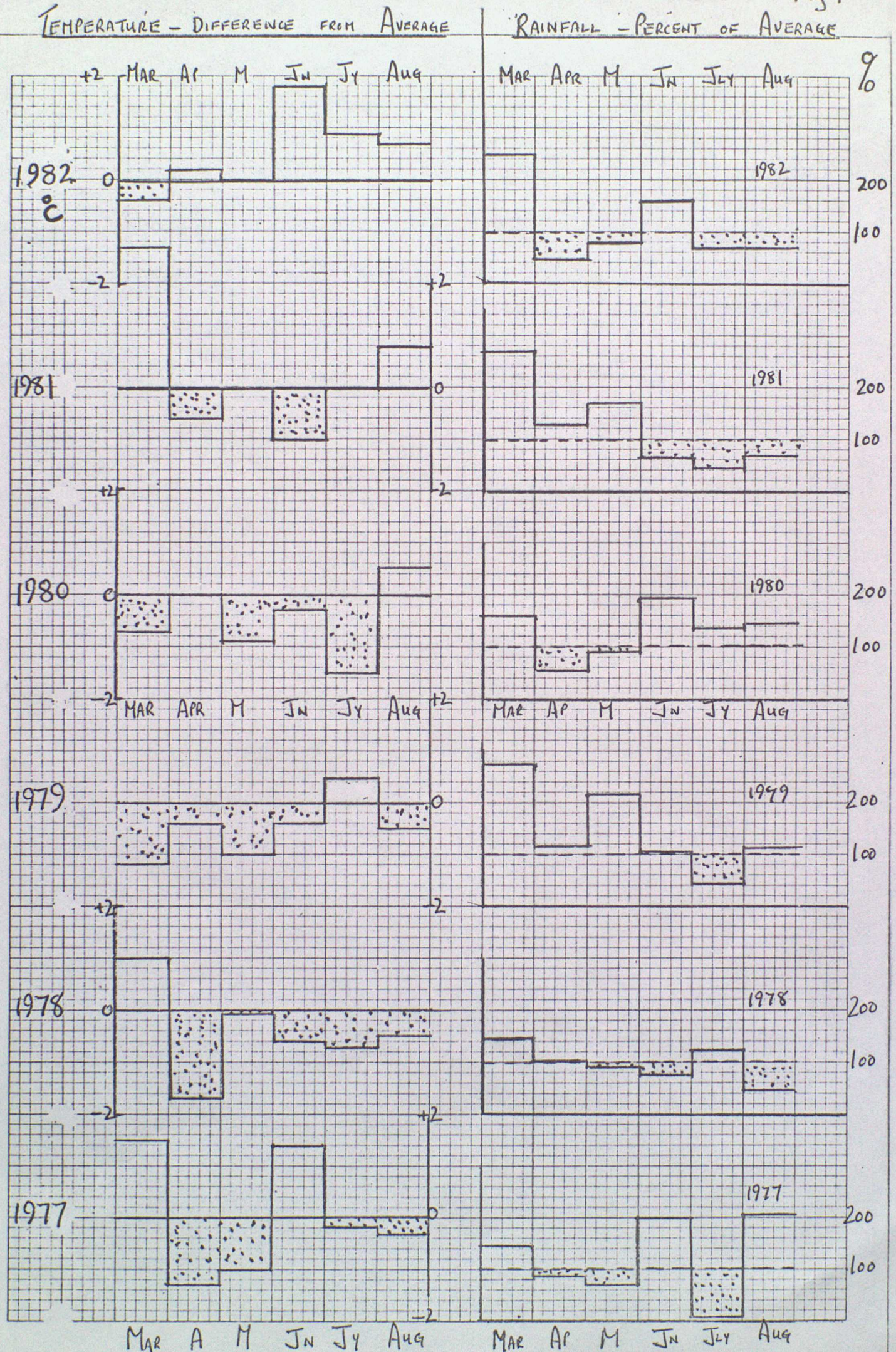

TEMPERATURE – DIFFERENCE FROM AVERAGE
RAINFALL – PERCENT OF AVERAGE
°C
%
+2
0
-2
MAR
APR
MAY
JUN
JLY
AUG
1982
1981
1980
1979
1978
1977
200
100

Fig 2

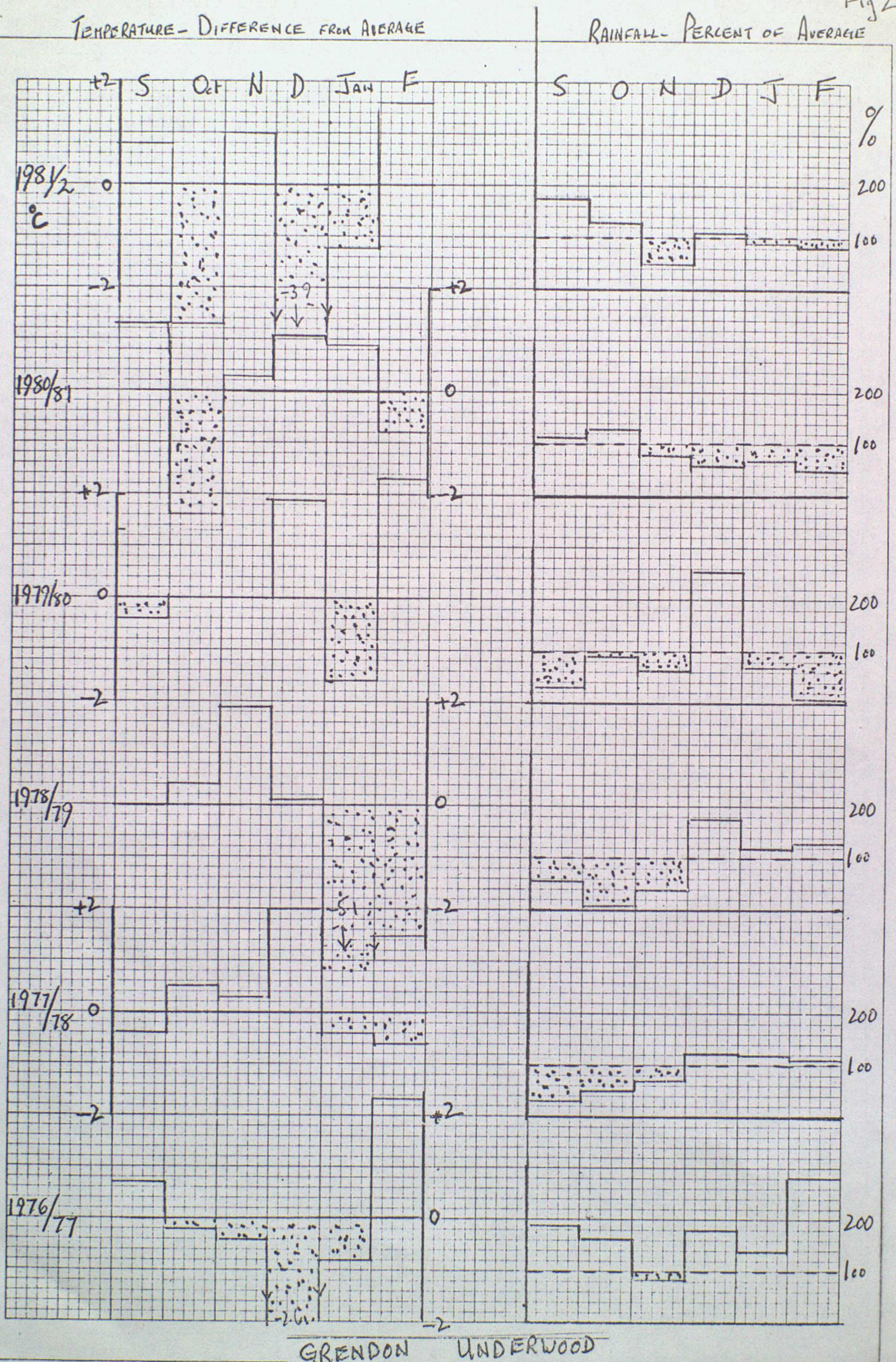
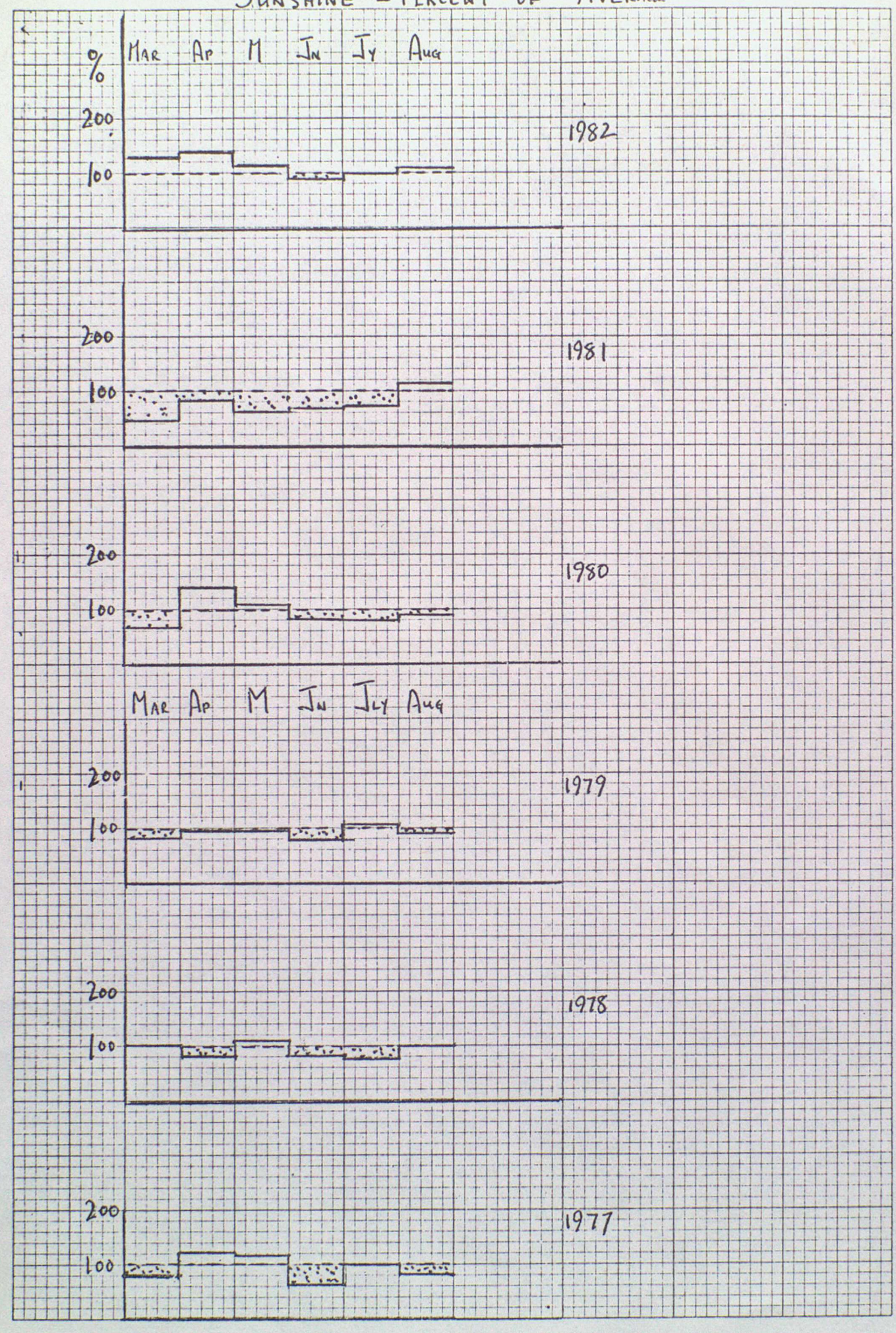

TEMPERATURE - DIFFERENCE FROM AVERAGE
RAINFALL - PERCENT OF AVERAGE
S O N D J F
S O Oct N D Jan F
°C
%
1981/2
1980/81
1979/80
1978/79
1977/78
1976/77
+2
0
-2
200
100
-3.9
-5.1
-2.6
GRENDON UNDERWOOD

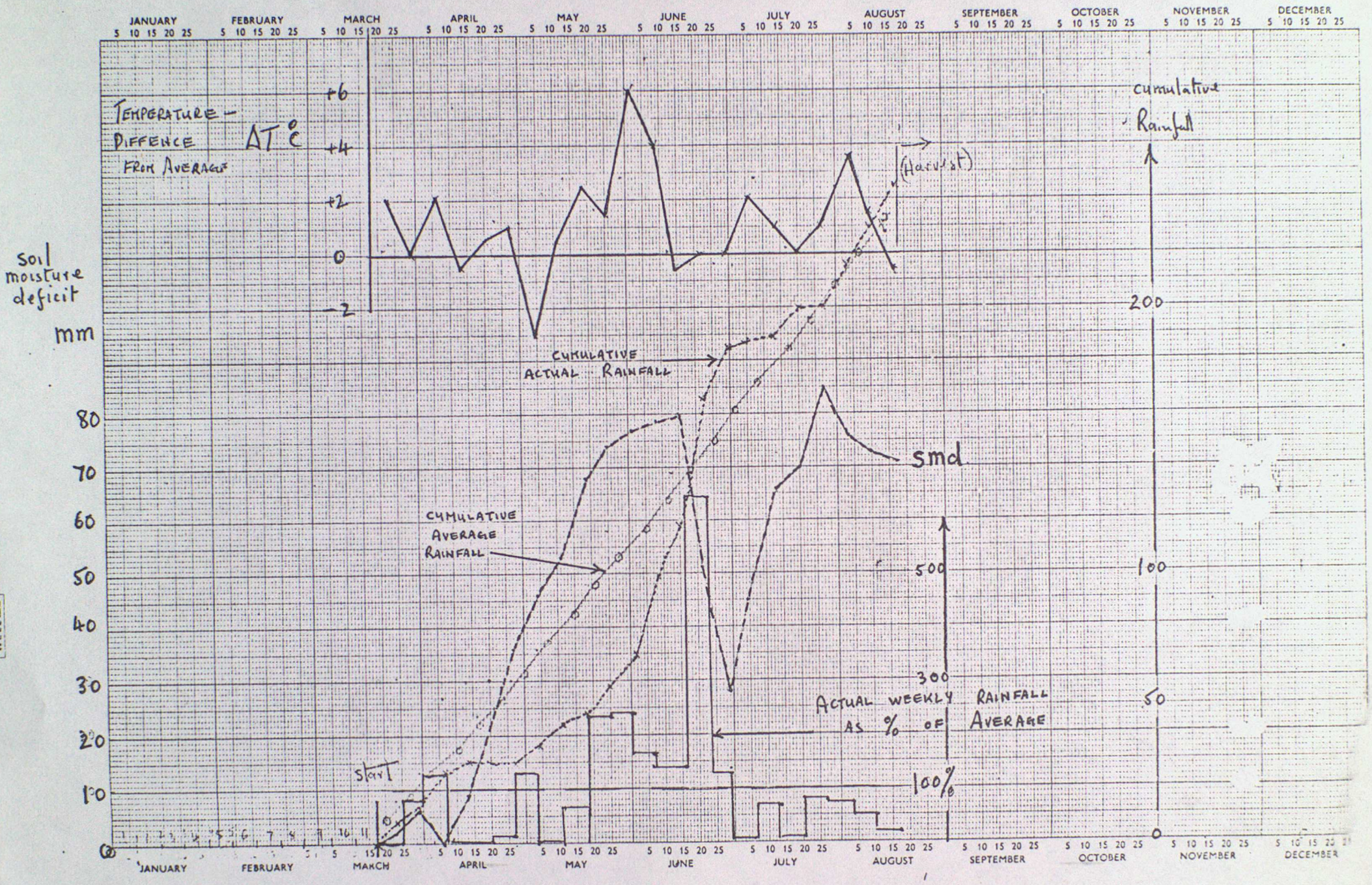
Fig 3

Sunshine – Percent of Average



Cereals Weather 1982

Fig 4



150 Equal Divisions x One Year (366 days)
Graph Data Ref. 4077
CONCEPT WELL Ltd

Fig 5

Grendon Underwood.

	Temperature						Rainfall						Sunshine					
	MAR	AP	M	JN	JY	AUG	MAR	AP	M	JN	JY	AUG	MAR	AI	M	J	J	AAG
1982	−	+/0	0	++	+	+	++	−−	−/0	+	−	−	+	+	+/0	−/0	0	+/0
81	++	−	0	−−	0	+	++	+/0	+	−	−−	−	−−	−	−−	−	−	+/0
80	−	0	−	−	−−	+	+	−	−/0	++	+	+	−	++	+/0	−/0	−/0	−/0
79	−−	−	−−	−	+	−	++	+/0	++	+/0	−−	+/0	−/0	0	0	−	+/0	−/0
78	++	−−	−/0	−	−	−	+	0	−/0	−	+/0	−−	0	−/0	+/0	−/0	−	0
77	++	−−	−−	++	−/0	−	+	−/0	−	++	−−	++	−	+	+/0	−−	0	−

Key:- ++ well above average, + above av., 0 about average, − below, −− well below av.

Winter barley

poor 1981, 79, 78 years: − −/0 − — cool in late spring/early summer; + +/0 — wet spring; − − − — low sunshine

good 1982, 80 years: − +/0 −/0; + − −/0 + — dry in late spring, wet June; + +/0 −/0 −/0 — sunny spring; less bright over early summer